9. ARA-02 SANITARY WASTE SYSTEM

Remedial action is required for the ARA-02 Sanitary Waste System to address the potential human health risk posed by contaminated sludge. Though the entire system will be removed, the risk at the site is associated only with the residual dry sludge in the system's seepage pit. The site characteristics including the nature and extent of contamination, the summary of site risks, remedial action alternatives, and the selected remedy are presented below. More detailed information about the sanitary waste system can be found in the WAG 5 Comprehensive RI/FS report (Holdren et al. 1999).

The ARA-02 site is a sanitary septic system comprising three septic tanks in series, a seepage pit, and the associated piping. The system was built in 1960 and serviced permanent and temporary ARA-I buildings until 1988 when ARA-I was inactivated. The ARA-02 septic system was designed and intended exclusively for sanitary waste. No known process waste was routed to the system, and no recorded spills or documented incidents were associated with the septic system. However, periodic surveys indicated radiological contamination. The source of the contamination is unknown. The site investigations, the summary of the risk assessment, and the nature and extent of contamination for COCs are presented below. Aerial photographs of Site ARA-02 before and after the D&D of ARA-I are shown in Figure 21.

9.1 Site Investigations

As part of a Track 2 investigation (Pickett et al. 1993), soil samples were collected along the main line and outside of the seepage pit and septic tanks. The contents of the tanks, seepage pit, and main line also were sampled. The septic tanks and seepage pit contained RCRA F-listed (40 CFR 261, Subpart D) mixed waste, and low concentrations of contaminants were detected in the soil along the sides of the septic tanks and seepage pit. None of the soil samples, including those obtained outside the seepage pit, yielded concentrations of RCRA hazardous constituents. Low levels of beryllium, U-234, U-238, and Sr-90 were detected during the Track 2 sampling of the pipeline between the septic tanks and the seepage pit. Samples were not analyzed for gamma-emitting radionuclides. In addition, the liquid levels inside the tanks were observed and found to vary over time, which indicated possible leakage to the soil below (Parsons 1996). On the basis of the Track 2 risk evaluation, removal of the septic tank contents, confirmation sampling, and a reevaluation of the site in the WAG 5 Comprehensive RI/FS were recommended.

In September 1996, a time-critical removal action was implemented at ARA-02 to remove the septic tank contents and to sample the seepage pit interior (Dietz 1998). The contents of all three septic tanks were removed and placed in drums in an approved temporary accumulation area to await final disposition. The sampling information from the 1996 removal action was reviewed and incorporated into the RI/FS.

The status of the integrity of the septic system was the only data gap identified for ARA-02 in the WAG 5 Work Plan (DOE-ID 1997a). Further investigation was planned to support site characterization, risk assessment, and the evaluation of remedial alternatives. Because the septic tanks and seepage pit are some distance apart, the risk for the soil surrounding the three septic tanks was evaluated separately from the seepage pit. The pipeline between the structures was not identified as a data gap and, therefore, was not investigated further. The data collected in 1997 to evaluate the two source areas in the WAG 5 Comprehensive RI/FS are summarized below.

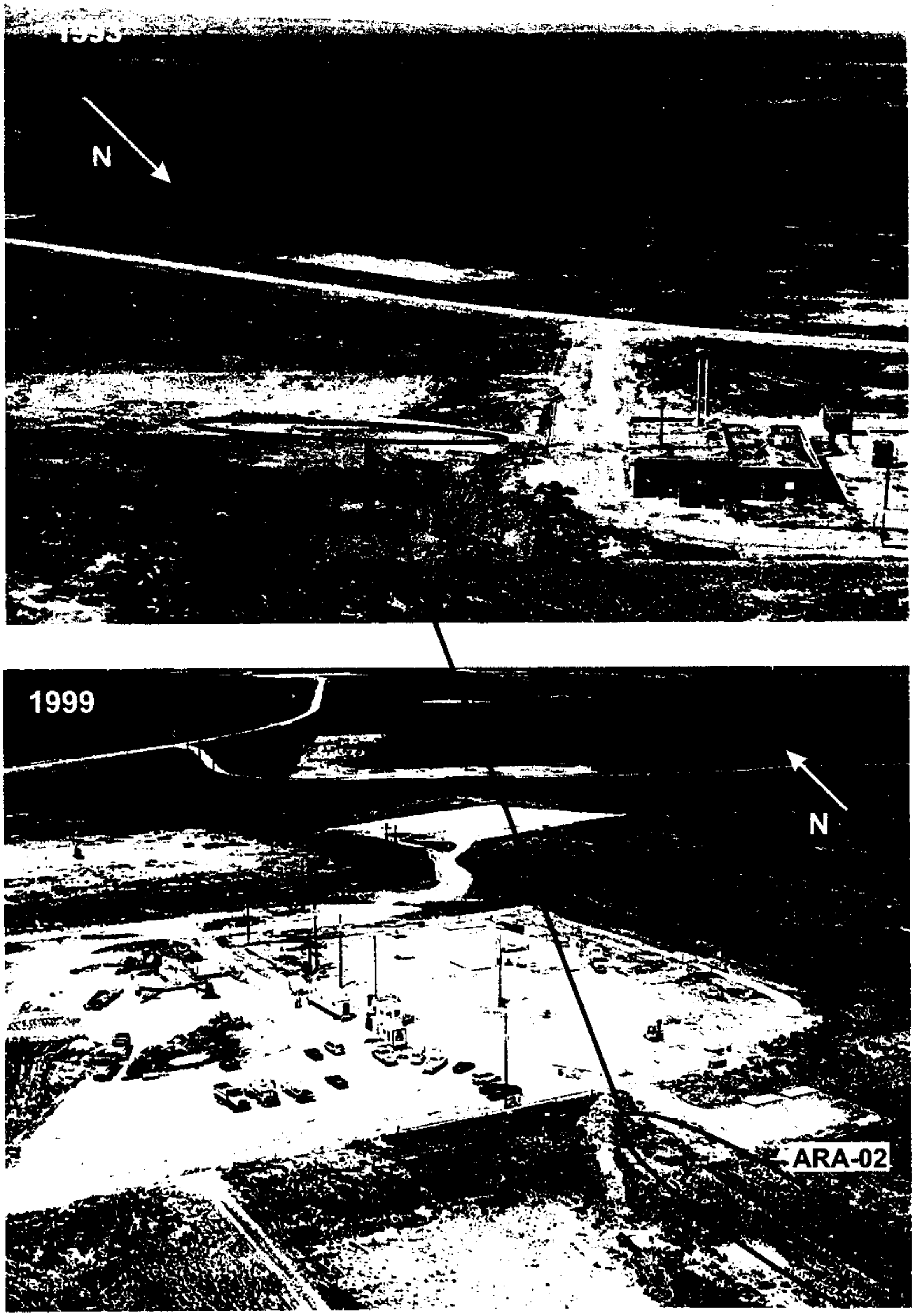

Figure 21. Aerial photographs of Site ARA-02 before and after the decontamination and dismantlement of the ARA-I facility.

9.1.1 Investigations of the ARA-02 Septic Tank Soils

Sampling plans for the septic tank soil (DOE-ID 1997a) included collecting soil from boreholes drilled beside each of the three septic tanks and sampling the basalt interface. Boreholes were drilled, and samples were obtained from the soil adjacent to the first two septic tanks. Several attempts to drill a borehole next to the third septic tank were unsuccessful because the septic tank was blasted into basalt and the interface was only a few feet below land surface. Therefore, samples could be collected only from shallow soil rather than at the base of the tank (Wilson-Lopez 1997). Concentrations of arsenic, lead, Ra-226, Sr-90, U-234, and U-235 were detected in the septic tank soil in excess of human health contaminant screening levels. The complete sample results are given in the WAG 5 Comprehensive RI/FS report (Holdren et al. 1999, Appendix E).

9.1.2 Investigations of the ARA-02 Seepage Pit

Samples were collected from both the interior of the seepage pit and from the soil outside of the pit. The seepage pit interior was sampled for radionuclides and hazardous constituents as determined by the removal action report during the time-critical removal action (Dietz 1998). Exterior soil samples were analyzed for radionuclides, toxicity characteristic leaching procedure (40 CFR 261.24) metals, PCBs, and volatile organics.

The construction details for the pit indicated that the top of the pit was 23 cm (9 in.) below the surface, the bottom was 2.4 to 2.9 m (8 to 9.5 ft) below the surface, and the pit bottom had a 20-cm (8-in.) foundation with an opening in its center to allow subsurface drainage. When the first borehole was drilled approximately 45.7 cm (18 in.) from the side of the seepage pit, samples were collected from the interval at 1 to 1.2 m (3.5 to 4 ft). However, samples could not be collected at 2.9 to 3 m (9.5 to 10 ft) because cobble had been used to surround the pit instead of dirt. A clay layer at the basalt interface was too small for an adequate sample (Wilson-Lopez 1997). A second borehole was attempted on the opposite side of the seepage pit, but no samples could be obtained because of cobble and basalt. A third attempt between the first borehole and the seepage pit wall was successful, and the clay layer at the basalt interface was thick enough to obtain an adequate sample (Wilson-Lopez 1997). Each sample and each borehole at the basalt interface were surveyed for radioactivity, and no measurable radioactivity was detected (Wilson-Lopez 1997).

Contaminants detected in the sludge at concentrations in excess of human health screening levels include Ag-108m, Am-241, Co-60, Cs-134, Cs-137, Eu-152, Eu-154, Np-237, Pu-238, Pu-239/240, Ra-226, Sr-90, Tc-99, Th-230, U-234, U-235, U-238, arsenic, cadmium, chromium, copper, lead, nickel, silver, Aroclor-1242, and diethylether. Based on process knowledge, the sludge was identified as RCRA F-listed waste. The contaminants detected in the soil surrounding the seepage pit include Am-241, Cs 137, Eu-152, Ra-226, U-234, U-235, U-238, arsenic, chromium, copper, lead, and nickel. Ecologically based screening levels were exceeded for barium, chromium, and copper in the soil outside of the seepage pit.

9.2 Nature and Extent of Contamination

The location of ARA-02 relative to ARA-I, contaminant profiles for the COCs, and the source volume used in the risk assessment are illustrated in Figure 22. The ARA-02 site was treated as two individual sources in the BRA: (1) the seepage pit and (2) the soil around the septic tanks. Only the contaminants in the seepage pit sludge are identified as COCs. However, the entire Sanitary Waste System will be removed during remediation of the site.

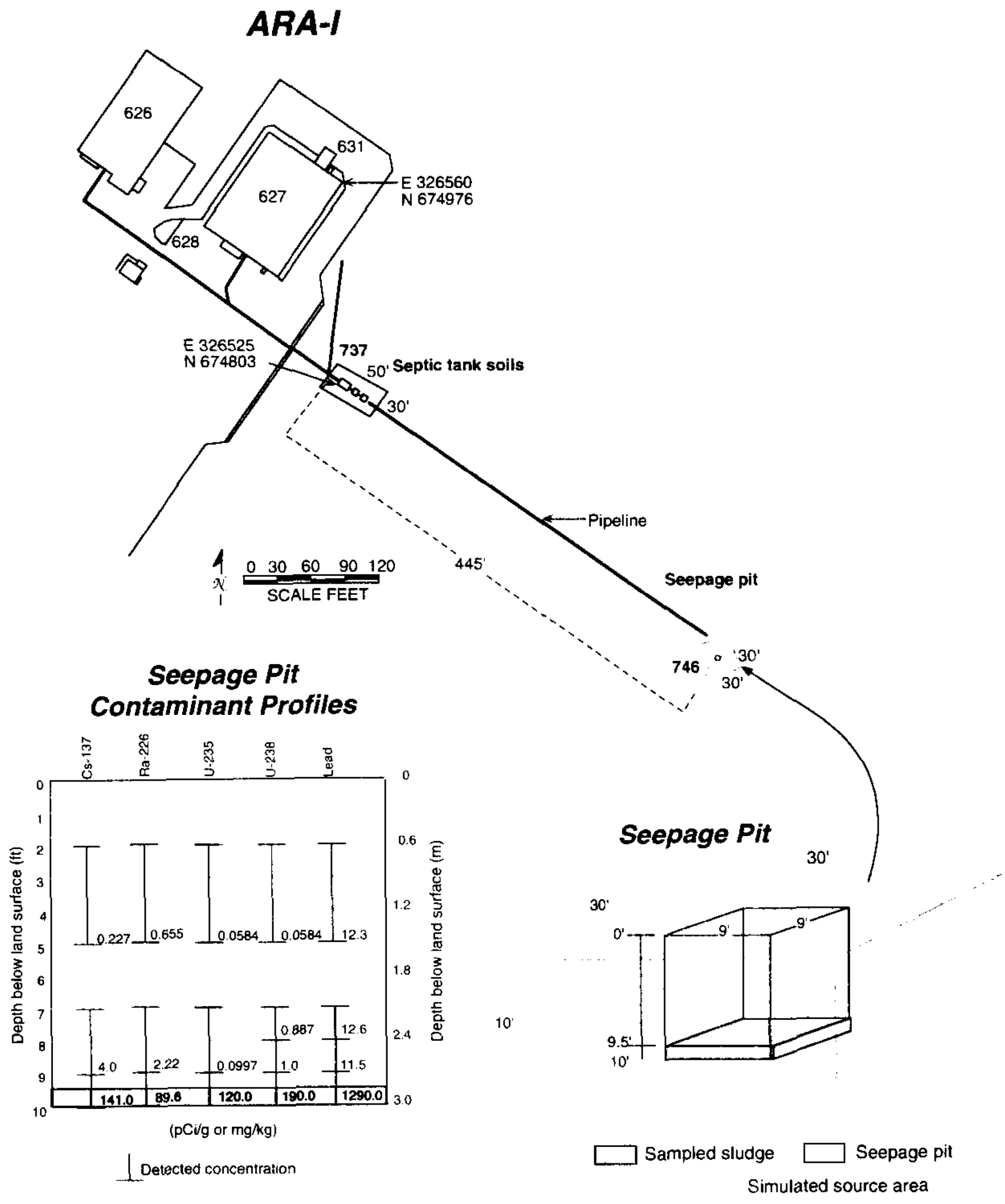

Figure 22. Site ARA-02, ARA-I Sanitary Waste System.

The COCs in the seepage pit sludge are represented in Figure 22 as the depth interval from 2.9 to 3 m (9.5 to 10 ft). The area above 3 m (9.5 ft) is void space. The 0.6 to 1.5-m (2 to 5-ft) and 2.1 to 2.7-m (7 to 9-ft) concentrations were detected in the soil outside of the seepage pit. These concentrations are all less than remediation goals.

9.3 Summary of Site Risks

The ARA-02 seepage pit was retained for quantitative risk assessment in the WAG 5 comprehensive BRA (Holdren et al. 1999) to evaluate the human health risk from contaminants detected in the seepage pit sludge and the human and ecological risks associated with seepage pit soil.

9.3.1 ARA-02 Seepage Pit Human Health Risk Assessment

Because the septic tanks and seepage pit are separated by approximately 122 m (400 ft) of pipe, the risk for the soil surrounding the three septic tanks was evaluated separately from the seepage pit. The evaluation incorporated the assumption that the pipeline between the septic tanks and the seepage pit is not a source of environmental contamination. No COCs were identified for the septic tank soil because the total risk for all contaminants is less than 1 E-04 for the future residential scenario.

Concentrations detected in the seepage pit sludge were evaluated as concentrations in soil. Cesium-137, Ra-226, U-235, U-238, and lead were identified as COCs based on the results of the human health risk assessment. A summary of the information about the COCs in soil at ARA-02 is given in Table 21.

Table 21. Soil concentrations[a] for the contaminants of concern at ARA-02.

Contaminant of Concern	Half-life (years)	Minimum Concentration (pCi/g or mg/kg)	Maximum Concentration (pCi/g or mg/kg)	Frequency of Detection	Background Concentration[b] (pCi/g or mg/kg)	Exposure Point Concentration (pCi/g or mg/kg)	Statistical Measure[c]
Cs-137	30	0.23	178	14/16	0.82[d]	15.0	UCL
Ra-226	1,600	1.68	89.6	9/10	1.2 or 2.1[e]	9.6	UCL
U-235	7.0E+08	0.058	120	16/19	0	12.0	UCL
U-238	4.5E+09	0.687	190	14/16	1.4[d]	19.4	UCL
Aroclor-1242	NA	5.5	23.5	10/13	0	1.8	UCL
Lead	NA	11.5	1,290	14/14	17[d]	NC[f]	NC

a. The contaminant concentrations were detected in the sludge, but risk was evaluated using soil parameters.

b. The exposure point concentration is the 95% upper confidence limit on the mean soil concentration averaged over a 3-m (10-ft) soil interval.

c. The UCL is the 95% upper confidence limit on the mean soil concentration.

d. The background value for composited samples is from Rood, Harris, and White (1996).

e. The average INEEL background concentration is 1.2 pCi/g for analysis that accounts for U-235 and 2.1 pCi/g to include interference from U-235 (Giles 1998a).

f. NC = not calculated

The total estimated risk associated with the seepage pit for all pathways for the 100-year future residential scenario is 2E-03 (2 in 1,000). The primary components are 2E-03 (2 in 1,000) from Ra-226, 9E-05 (9 in 100,000) from U-235, 7E-05 (7 in 100,000) from Cs-137, and 3E-05 (3 in 100,000) from U-238. In addition, Aroclor-1242 and lead may pose threats to human health.

Reference doses specific to the PCB Aroclor-1242 have not been approved by the EPA. Values for Aroclor-1254 were used to assess the qualitative magnitude of the potential hazard index for Aroclor-1242. Because the estimated noncarcinogenic hazard index is greater than 1.0, Aroclor-1242 was identified as a COC.

Human health risk from lead could not be quantified because toxicity data for lead have not been developed. However, the maximum detected concentration of lead in the seepage pit sludge, 1,290 mg/kg, exceeds the EPA 400 mg/kg screening level for soil (EPA 1994b). Therefore, remediation of the seepage pit will mitigate potential adverse effects from lead.

The concentrations of Ra-226 in the ARA-02 seepage pit sludge ranged from 1.6 to 89.6 pCi/g. Because the sample concentrations are well above the INEEL background concentration of 1.2 pCi/g (Giles 1998a), a correction factor was not developed and Ra-226 was identified as a COC.

The total estimated risk for all pathways for the current occupational scenario is less than 1E-04, and the noncarcinogenic hazard index for the current occupational scenario is less than 1.0.

The total risk estimated for all pathways for the 100-year occupational scenario is less than 1E-04, and the noncarcinogenic hazard index for the future occupational scenario is less than 1.0.

9.3.2 ARA-02 Ecological Risk Assessment

No COCs were identified for the septic tank soil based on the results of the ERA because the threshold HQ value of 1 was not exceeded. The seepage pit sludge is not available to ecological receptors.

9.4 Remediation Objectives for the ARA-02 Sanitary Waste System

Remediation objectives based on the unacceptable risks discussed previously (Section 9.3) were developed for the ARA-02 Sanitary Waste System. No unacceptable ecological risk is associated with the system. Human health risk in excess of 1E-04 is posed primarily by external exposure to ionizing radiation. The radioactive contaminants of concern are Cs-137, Ra-226, U-235, and U-238. Dermal adsorption and ingestion of PCBs and ingestion of lead pose secondary human health risks. A summary of the risks is provided in Table 7.

Remedial action objectives for the ARA-02 Sanitary Waste System apply only to the ARA-02 seepage pit sludge because all COCs at the site are contained within the sludge. The following remedial action objectives were developed to protect human health:

- Inhibit direct exposure to radionuclide COCs that would result in a total excess cancer risk greater than or equal to 1 in 10,000 for current and future workers and future residents.

- Inhibit dermal adsorption of contaminants of concern that would result in a total excess cancer risk greater than or equal to 1 in 10,000 or a hazard index of 2 or greater for current and future workers and future residents.

To meet these objectives, remediation goals were established. Except for lead and the PCB Aroclor-1242, the remediation goals for ARA-02 are risk-based soil concentrations equivalent to a risk of 1E-04 in the future residential scenario. The remediation goals and the basis for each goal are provided in Table 22. These goals are at the upper end of the acceptable risk range because conservative parameters

Table 22. Remediation goals for the ARA-02 Sanitary Waste System.

Contaminant of Concern	Soil Concentration Remediation Goal	Derivation	Reference	Risk Scenario
Cs-137	8.5 pCi/g[a]	Calculated based on 1E-04 cumulative external exposure risk	Fromm (1996)	100-year future residential
Ra-226	1.2 or 2.1 pCi/g[b]	Background concentration	Giles (1998a)	100-year future residential
U-235	6.2 pCi/g[a]	Calculated based on 1E-04 cumulative external exposure risk	Fromm (1996)	100-year future residential
U-238	10.6 pCi/g[a]	Calculated based on 1E-04 cumulative external exposure risk	Fromm (1996)	100-year future residential
Aroclor-1242	1 mg/kg[c]	Toxic Substance Control Act	40 CFR 761.61(a)(i)(A)[c]	Unrestricted release
Lead	400 mg/kg	EPA	Statutes[d]	Human health[c]

a. The remediation goals for Cs-137, U-235, and U-238 are weighted averages based on relative risk contributions and 100 times the 1E-06 risk-based soil concentrations reported by Fromm (1996). The cumulative risk for Cs-137, U-235, and U-238 is 1E-04 at the remediation goal soil concentrations.

b. The remediation goal is the average INEEL background value for Ra-226 reported by Giles (1998a) because the 1E-04 risk-based concentration derived from Fromm (1996), 0.55 pCi/g, is below the INEEL average background concentration. A goal of 2.1 pCi/g will be used for comparison of sample results that may include interference from U-235. Otherwise, a goal of 1.2 pCi/g will be used. Further details are available in Giles (1998a).

c. The reference addresses polychlorinated biphenyl remediation waste for high-occupancy areas. Though the seepage pit sludge is not remediation waste, 1-mg/kg was identified as a protective remediation goal for the Aroclor-1242 contained in the seepage pit sludge. A noncarcinogenic risk-based remediation goal could not be developed because a reference dose for calculating a hazard quotient specific to Aroclor-1242 is not available. The toxicity of Aroclor-1242 was qualitatively assessed using the reference doses for Aroclor-1254.

d. On July 14, 1994, the EPA issued guidance recommendations for lead in paint, dust, and soil under the authority of Section 1021, Title X of the Housing and Community Development Act of 1992; and Section 403 of the Toxic Substance Control Act. The current approach to addressing lead in soil at CERCLA and RCRA sites was established in Office of Solid Waste and Emergency Response (OSWER) Directive 9555.4-12 (EPA 1994b). Human health risks were not quantified because approved toxicity data for risk calculations are not available.

were used in the risk assessment, because risk from background concentrations at the INEEL exceed 1E-06, and because EPA radiation standards, which apply to risks from exposure to radionuclides, are generally set at a risk level of 1 in 10,000.

Remediation goals can be satisfied by either cleaning up to the identified contaminant concentration (see Table 22) or by removing all contaminated media down to the basalt interface. Removing soil down to basalt will be protective because surface exposure pathways will be eliminated. The WAG 5 Comprehensive RI/FS (Holdren et al. 1999) showed that groundwater exposure pathways pose a cumulative risk less than 1E-04 and a hazard index less than 1 for the baseline no action alternative. Removal of contaminated media from WAG 5 will further reduce the potential groundwater risk. Therefore, remediation to retrieve residual contamination that may have migrated into the fractured basalt would not be justified.

9.5 Description of Alternatives for the ARA-02 Sanitary Waste System

Four primary remedial alternatives were developed for the ARA-02 Sanitary Waste System: Alternative 1, no action; Alternative 2, limited action; Alternative 3, removal, ex situ treatment, and disposal; and Alternative 4, in situ stabilization and encapsulation. Alternative 2, limited action, was screened out in the feasibility study because it did not provide protection of human health beyond the 100-year period of institutional control. Alternative 3b, removal, ex situ chemical stabilization, and disposal (a subcategory of Alternative 3), also was screened out in the feasibility study because chemical stabilization is not as effective as thermal treatment, the implementability is lower, and the cost is higher. Though Alternative 1, no action, does not satisfy threshold criteria, it was retained for detailed evaluation to serve as the baseline for comparing other remedial action alternatives.

9.5.1 Alternative 1, No Action

The no action alternative developed for the ARA-02 Sanitary Waste System consists of groundwater, air, and soil monitoring. Based on the WAG 5 BRA (Holdren et al. 1999), additional groundwater monitoring would not be required for ARA-02 seepage pit waste because the risk assessment modeling indicates that migration of the current contents of the seepage pit would not affect groundwater. No active remediation would be performed under this alternative to alter existing site conditions.

9.5.2 Alternative 3a, Removal, Ex Situ Thermal Treatment, and Disposal

Alternative 3a, removal, ex situ thermal treatment, and disposal, comprises excavation of the seepage pit, removal of the sludge, shipment, ex situ thermal treatment outside of WAG 5, and disposal of the treated waste. The seepage pit would be excavated using conventional construction equipment.

The seepage pit sludge can be accepted for incineration at WERF. Because the sludge is dry, no adsorbents would be necessary. Treated residuals would be stabilized if necessary to meet the disposal criteria of an off-Site permitted facility such as Envirocare in Clive, Utah. The pumice blocks, concrete septic tanks, and associated piping would be shipped for disposal to an off-Site permitted facility such as Envirocare.

9.5.3 Alternative 4, In Situ Stabilization and Encapsulation

Alternative 4, in situ stabilization and encapsulation, consists of partially filling the seepage pit with soil and then grouting the seepage pit sludge and pumice blocks in place. In addition, the three empty concrete septic tanks and associated piping would be filled with grout. Jet grouting would be used in the seepage pit to ensure adequate mixing of the sludge with the grout material to stabilize the waste and completely encapsulate the entire seepage pit system. After the seepage pit is stabilized and encapsulated, a gravity feed system would be used to fill the remainder of the septic system with grout.

Institutional controls and environmental monitoring would be implemented to restrict access and confirm that contamination was not migrating from the site. Institutional controls include deed restrictions and construction of perimeter fencing. The environmental monitoring would include groundwater and vadose zone monitoring, radiation surveys, and soil sampling and analysis. Five-year reviews would be conducted to evaluate the effectiveness of the institutional controls and treatment and identify maintenance needs.

9.5.4 Comparison of Elements and Distinguishing Features of Each Alternative

The relative performance of each alternative is described in Table 23.

9.6 Comparative Analysis of Alternatives for the ARA-02 Sanitary Waste System

The alternatives were evaluated using the nine evaluation criteria as specified by CERCLA (40 CFR 300.43[f][5][i]). The purpose of this comparison is to identify the relative advantages and disadvantages associated with each alternative. The comparative analyses of alternatives for the nine criteria are summarized below.

9.6.1 Overall Protection of Human Health and the Environment

Alternative 1, no action, would not prevent exposures resulting in risks greater than 1E-04 or hazard indices greater than 1.0 for ARA-02. Alternative 3a, excavation, ex situ thermal treatment, and disposal, would provide the most effective long-term protection of human health and the environment because the contaminated media would be removed from WAG 5. Alternative 4, in situ stabilization and encapsulation, would be somewhat less protective within WAG 5 because the stabilized waste would remain at ARA-I.

9.6.2 Compliance with ARARs

The ARARs for Alternative 1, no action, would not be met for ARA-02. Alternative 3a, removal, ex situ thermal treatment, and disposal, and Alternative 4, in situ stabilization and encapsulation, both meet all ARARs.

9.6.3 Long-Term Effectiveness and Permanence

Alternative 1, no action, would provide the least long-term effectiveness and permanence for ARA-02. Alternative 3a, excavation, ex situ thermal treatment, and disposal, would provide the highest degree of long-term effectiveness and permanence because the waste would be removed from WAG 5.

9.6.4 Reduction of Toxicity, Mobility, or Volume through Treatment

For ARA-02, for all considered alternatives, with the exception of Alternative 1, no action, the waste would be treated to reduce toxicity, mobility, and volume. When compared to Alternative 4, in situ stabilization and encapsulation, Alternative 3a, removal, ex situ thermal treatment, and disposal, would provide greater reduction in toxicity, mobility, and volume.

Table 23. Detailed analysis summary of remediation alternatives for the ARA-02 Sanitary Waste System.

Criteria	Alternative 1 No Action	Alternative 3a Removal, Ex Situ Thermal Treatment, and Disposal	Alternative 4 In Situ Stabilization and Encapsulation
Overall protection of human health and the environment			
Human health protection	No reduction in risk.	Would eliminate potential exposure to waste by removing contamination from WAG 5.	Would eliminate potential exposure by stabilizing and encapsulating the waste.
Environmental protection	Allows continued ecological exposures and risk of tank waste release.	Would eliminate potential ecological exposure to waste by removing contamination from WAG 5.	Would eliminate potential exposure by stabilizing and encapsulating the waste.
Compliance with applicable, relevant, and appropriate requirements (ARARs)			
Action-specific			
Idaho Hazardous Waste Management Act—IDAPA 16.01.05.006, .008, and .011	Would not meet ARAR.	Would meet ARAR.	Would meet ARAR.
Resource Conservation and Recovery Act—40 CFR 262, 264, and 268	Would not meet ARAR.	Would meet ARAR.	Would meet ARAR.
Idaho Fugitive Dust Emissions—IDAPA 16.01.01.650 through .651	Not applicable	Would meet ARAR through use of engineering controls.	Would meet ARAR through use of engineering controls.
Rules for Control of Air Pollution in Idaho—IDAPA 16.01.01.210, and IDAPA 16.01.01.585 through .586:	Not applicable	Would meet ARAR through use of engineering controls.	Would meet ARAR through use of engineering controls.
NESHAP—40 CFR 61.92 and .93	Would meet ARAR because waste is not a source of air emissions.	Would meet ARAR through use of engineering controls.	Would meet ARAR through use of engineering controls.
Chemical-specific			
Idaho Groundwater Quality Rule—IDAPA 16.01.11.200	Would not meet ARAR.	Not applicable	Would meet ARAR through monitoring.
Location-specific			
Rules for Control of Air Pollution in Idaho—IDAPA16.01.01.581	Not applicable	Would meet ARAR through use of engineering controls.	Would meet ARAR through use of engineering controls.
Native American Graves Protection and Repatriation Act—25 USC 32	Would meet ARAR.	Would meet ARAR through surveys and assessments and actions deemed necessary.	Would meet ARAR through surveys and assessments and actions deemed necessary.
National Archeological and Historic Preservation Act—36 CFR 800	Would meet ARAR.	Would meet ARAR through surveys and assessments and actions deemed necessary.	Would meet ARAR through surveys and assessments and actions deemed necessary.
To be considered (TBC)			
Radiation Protection of the Public and Environment—DOE Order 5400.5	Would not meet TBC because no controls would be implemented.	Would meet TBC through use of administrative controls.	Would meet TBC through use of administrative controls.

Table 23. (continued).

Criteria	Alternative 1 No Action	Alternative 3a Removal, Ex Situ Thermal Treatment, and Disposal	Alternative 4 In Situ Stabilization and Encapsulation
Long-term effectiveness and permanence			
Magnitude of residual risk	No change from existing risk.	No residual risk would remain at the site.	Would eliminate source-to-receptor pathways.
Adequacy and reliability of controls	No control and, therefore, no reliability.	Disposal facilities for treated waste, contaminated soil, and debris are assumed to provide adequate and reliable control for the period of institutional control.	Stabilized waste form is estimated to provide reliable control over contamination in waste for at least 1,000 years
Reduction of toxicity, mobility, or volume through treatment			
Treatment process used	Not applicable	Incineration	Stabilization and encapsulation
Amount destroyed or treated	Not applicable	Approximately 100%	Approximately 100%
Reduction of toxicity, mobility, or volume	Not applicable	50 to 80% volume reduction, 70% mobility reduction, and 50% toxicity reduction.	20 to 50% volume increase, more than 90% mobility reduction, 0% toxicity reduction.
Irreversible treatment	Not applicable	Not reversible, but would afford long-term stability.	Not reversible, but would afford long-term stability
Type and quantity of residuals remaining after treatment	Not applicable	No waste would be left at the site. Incinerator ash would remain after treatment of the seepage pit sludge.	Stabilized waste form, decontamination fluids, used personal protective equipment, and air pollution control filters
Statutory preference for treatment	Not applicable	Meets preference.	Meets preference.
Short-term effectiveness			
Community protection	Would not increase potential risks to the public.	Would be slight increase in potential risks to the public during transportation.	Would not increase potential risks to the public.
Worker protection	Not applicable	Workers would be protected by engineering and administrative controls.	Workers would be protected by engineering and administrative controls.
Environmental impacts	No change from existing conditions.	Limited to disturbances from vehicle and material transport activities associated with excavation of the seepage pit. Use of containment systems with high-efficiency particulate air filtration and dust suppressants would significantly limit the potential for airborne contamination.	Limited to disturbances from vehicle and material transport activities associated with jet grouting of the seepage pit and grouting of the septic tanks and associated piping. Use of containment systems with high-efficiency particulate air filtration and dust suppressants would significantly limit the potential for airborne contamination.
Time until action is complete	Not applicable	Approximately 18 to 24 months	Approximately 12 to 15 months

Table 23. (continued).

Criteria	Alternative 1 No Action	Alternative 3a Removal, Ex Situ Thermal Treatment, and Disposal	Alternative 4 In Situ Stabilization and Encapsulation
Implementability			
Ability to construct and operate	No construction or operation.	Easy. Implementation would involve available excavation, transportation, and treatment technology	Easy, would involve available grouting and construction technology.
Ease of implementing additional action if necessary	Could require repeat of feasibility study and record of decision process.	Easy. The incinerator residue could be stabilized or encapsulated using existing technology.	Moderately difficult. The stabilized waste form could be excavated, removed, and disposed of if required.
Ability to monitor effectiveness	Monitoring of conditions would be readily implemented.	Sampling of waste residues to verify treatment performance would be routine.	The effectiveness in stabilizing all contaminants would be easily monitored.
Ability to obtain approvals and coordinate with regulatory agencies	No approvals required.	Relatively easy	Relatively easy
Availability of services and capacity	None required.	Services would be available at the INEEL.	Services available at the INEEL or through a subcontractor.
Availability of equipment, specialists, and materials	None required.	Equipment and materials would be either available at the INEEL, through subcontractors, or would be purchased.	Equipment and materials would be available either at the INEEL, through subcontractors, or would be purchased.
Availability of technology	None required.	Available at the INEEL	Available at the INEEL and commercially.
Cost (net present value, 5% discount rate)[a]			
Capital Cost	$1.6 million	$2 million	$1.9 million
Operations and Maintenance Cost	$7.7 million	NA	$5.6 million
Total Cost	$9.3 million	$2 million	$7.5 million

a. Details of the cost estimates are provided in the RI/FS report (Holdren et al. 1999, Appendix K).

9.6.5 Short-Term Effectiveness

Alternative 1, no action, would be the most effective in the short term because no actions resulting in additional worker exposure would occur. No off-Site exposures will occur because none of the sites are located near inhabited areas and no public roads are in the vicinity. No additional environmental impacts will result from this alternative other than from extant conditions. In the short term, Alternative 4, in situ stabilization and encapsulation, is more effective than Alternative 3a, removal, ex situ thermal treatment, and disposal, because no potential receptors would be in direct contact with the seepage pit sludge. However, because the contamination levels in the sludge are low, the risk to workers in implementing Alternative 3a would be low.

9.6.6 Implementability

Each of the alternatives retained for detailed analysis is technically implementable. Alternative 1, no action, would be the most implementable for ARA-02 because it would require no change from extant site conditions.

Alternative 3a, removal, ex situ thermal treatment, and disposal, and Alternative 4, in situ stabilization and encapsulation, are equally implementable. For both Alternatives 3a and 4, conventional and readily available equipment and technologies known to be effective would be used. The facilities for treatment of ARA-02 sludge under Alternative 3a presently exist at the INEEL. The jet grouting technique that would be used in Alternative 4 was developed and tested at the INEEL, and the equipment and methods required to implement the alternative are available commercially.

9.6.7 Cost

Alternative 3a, removal, ex situ thermal treatment, and disposal, is the least costly. Alternatives 1, no action, and 4, in situ stabilization and encapsulation, are higher in cost because of long-term monitoring of the site during the period of institutional control. Alternative 4 has increased capital and operating and maintenance costs over those of Alternative 3a.

9.6.8 State Acceptance

The IDHW has been involved in the development and review of the OU 5-12 RI/FS report (Holdren et al. 1999), the Proposed Plan (DOE-ID 1999b), and this ROD. All comments received from IDHW on these documents have been resolved and the documents revised accordingly. In addition, IDHW has participated in public meetings where public comments and concerns have been received and responses offered. The IDHW concurs with the selected remedial alternative for the ARA-02 Sanitary Waste System contained in this ROD and is a signatory to the ROD with DOE and EPA.

9.6.9 Community Acceptance

Community participation in the remedy selection process and Proposed Plan reviews included participation in the public meetings held May 17 through 19, 1999 (see Section 3). The 30-day public comment period was May 10, 1999, through June 9, 1999. The Responsiveness Summary, presented as Part 3 of this ROD, includes verbal and written comments received from the public and the DOE responses to these comments. Representatives of the EPA and IDHW assisted in the development of the responses.

All comments received on the Proposed Plan were considered during the development of this ROD. The public was supportive of the preferred alternative for the ARA-02 Sanitary Waste System and generally concurred with the conclusion that removal of the waste system is required to satisfy the CERCLA threshold criteria for protection of human health and the environment and compliance with the regulations.

9.7 Selected Remedy for the ARA-02 Sanitary Waste System: Alternative 3a, Removal, Ex Situ Thermal Treatment, and Disposal

The selected remedy for the ARA-02 Sanitary Waste System is Alternative 3a, removal, ex situ thermal treatment, and disposal. This remedy was selected based on the comparative analysis of alternatives. Alternative 3a is the least costly alternative that meets threshold criteria (i.e., provides overall protection of human health and the environment and satisfies ARARs), is easily implemented because the treatment technology exists at the INEEL and is currently operational, and long-term effectiveness is high because contamination will be permanently removed from the site and treated to reduce toxicity, mobility and volume. The estimated time required to complete remediation is 18 to 24 months. The activities to implement this alternative include the following:

- Excavation and removal of the sludge and all components of the septic system
- Shipment of the structural components of the system to an acceptable disposal facility (for cost estimation purposes, Envirocare was selected as the representative facility)
- Shipment of the sludge for treatment at WERF and then shipment of treated residuals to Envirocare
- Additional sampling of the soil to be excavated, the sludge in the seepage pit, and the septic tanks, piping, and pumice blocks
- Dust control and environmental monitoring to be conducted during active remediation.

The only waste in the system is the sludge in the bottom of the seepage pit. Waste was previously removed from the septic tanks. The dry sludge remaining in the seepage pit contains low concentrations of radionuclides, heavy metals, and organics, including Aroclor-1242. Analysis indicates that this sludge is not RCRA characteristic. However on the basis of sludge analysis from the septic tanks and process knowledge, the seepage pit sludge, pumice blocks, septic tanks, and associated piping are designated RCRA F-listed (i.e., F-001) for 1,1,1-trichloroethane and trichloroethylene.

It is not known when PCB material was introduced into the septic system, nor are the form and concentration of the original PCB material known. Therefore, the concentration of the PCB, as found in the sludge, was used to determine the regulatory status under TSCA in accordance with EPA guidance on cleanup of PCB waste under CERCLA (Clay and Fisher 1990; EPA 1990). Because the average concentration of Aroclor-1242 in the sludge is 13 mg/kg with a maximum concentration of 23 mg/kg, the sludge is not TSCA regulated. Remediation goals for the ARA-02 Sanitary Waste System are listed in Table 22.

Excavation and removal of the seepage pit and the associated septic system will require use of conventional excavation equipment such as backhoes and front-end loaders and hand digging. Soil will be removed first from around the seepage pit and septic system tanks and pipes. Because soil sample results indicate that the concentrations of all contaminants are well below the remediation goals, remediation of ARA-02 soil is not anticipated and the soil will be returned to the excavation.

After soil is removed from around the seepage pit, the pumice blocks will be removed, sampled and analyzed, then packaged for shipment to a RCRA permitted off-site disposal facility such as Envirocare. The pumice blocks comprising the walls of the seepage pit have not been sampled. Since the seepage pit was designed to allow waste to leach into the ground, it is assumed the blocks are contaminated with the same compounds detected in the sludge and at similar concentrations. Therefore, the blocks would meet RCRA land disposal criteria without treatment. However, if sampling indicates the blocks are contaminated at significantly higher levels than detected in the sludge, the disposal facility may be required to encapsulate the pumice blocks to satisfy waste acceptance criteria for disposal. Because of the porous nature of the pumice blocks, decontamination to meet the RCRA clean debris standard is not feasible.

The septic tanks and associated piping also will be removed, sampled, analyzed, and packaged for shipment to a RCRA-permitted mixed waste disposal facility off the INEEL, such as Envirocare. If the waste acceptance criteria for the ICDF or another INEEL facility allow disposal of RCRA-listed waste, the tanks and piping can be disposed of at the INEEL. Though the septic tanks and piping were not previously sampled, it is anticipated that contamination levels will be low. Septic tanks and the associated piping are typically constructed to be impervious and water tight, hence contamination should be limited to the surfaces that came in contact with the waste. Furthermore, after the contents were removed from the septic tanks during the previous removal action, the sides and bottom of the tanks were thoroughly scraped to remove all visible traces of waste (Dietz 1998). Therefore, it is anticipated that the tanks and pipes will meet RCRA land disposal criteria without further treatment. However, encapsulation at Envirocare will be performed if required to meet the waste disposal criteria.

The ARA-02 seepage pit sludge will be removed and packaged for shipment and incineration at WERF. Because the sludge is dry, no adsorbents would be necessary. The treatment residuals will be transported for disposal at a permitted disposal facility off the INEEL, such as Envirocare. If required, the treated residuals will be stabilized at WERF before shipment to meet the waste acceptance criteria for the disposal facility.

Current radiological and industrial hygiene control practices will be used to reduce radiation and exposure to toxic materials for workers. Radiological controls could consist of limiting the amount of time workers are allowed to work in the area, requiring personnel to wear personal protective clothing, and imposing distance and shielding limits to reduce radiation exposure. Industrial hygiene controls could include use of personal protective clothing to prevent dermal exposure to contaminants and respirators to prevent inhalation of toxic substances. Air emissions will be controlled by the use of water sprays or soil fixatives to suppress dust during soil excavation and removal.

During excavation, soil sampling and analysis will be performed to verify that the COC concentrations are less than the remediation goals. If soil is discovered with contamination exceeding soil remediation goals, the contaminated soil will be disposed of in conjunction with the remediation of the contaminated soil sites (see Section 8). Following removal of the ARA-02 Sanitary Waste System, the excavated site will be backfilled with uncontaminated soil, compacted, and vegetated in accordance with INEEL guidelines (DOE-ID 1989).

9.7.1 Cost

The estimated cost for Alternative 3a, removal, ex situ thermal treatment, and disposal, is $2 million. The elements of the cost estimate are summarized in Table 24 and details of the cost estimate are provided in the WAG 5 Comprehensive RI/FS report (Holdren et al. 1999, Appendix K). The cost analysis incorporates the assumption that post-closure monitoring and maintenance will not be required.

9.7.2 Estimated Outcomes of the Selected Remedy

Removal of all seepage pit sludge, contaminated gravel, and pumice blocks will result in a cleanup that exceeds the remediation goals and provides protection of current and future workers and residents. In addition, the removal of all three septic tanks and associated piping will preclude requirements for institutional control of the site. Remediation of the site can be completed within 24 months. The ARA-02 site will be under government control for at least 100 years and current land-use plans anticipate that this site will be designated for industrial use. The complete removal of all the structural components of the septic system along with the seepage pit sludge will make the site suitable industrial use, as well as residential use if the site becomes available for residential development after the 100-year institutional control period assumed for the risk assessment.

9.8 Statutory Determinations for the ARA-02 Sanitary Waste System

9.8.1 Overall Protection of Human Health and the Environment

Alternative 3a, removal, ex situ thermal treatment, and disposal, would provide highly effective, long-term protection of human health and the environment. Removal of all seepage pit sludge would eliminate potential long-term risks from exposure or contaminant migration, and removal of the structural components of the septic system will eliminate any hazards in the future associated with potential subsidence. Treatment of the sludge in the WERF incinerator will destroy any toxic organics and reduce the volume of waste. Envirocare or the INEEL Site disposal facility will provide isolation of the treated waste and contaminated septic tanks, piping, and seepage pit pumice blocks.

Alternative 3a is protective of the environment during implementation because mitigative measures to prevent contaminant migration during excavation activities would be implemented. Short-term protection of human health is only moderate because workers could receive exposure to the seepage pit sludge and contaminated structures of the septic system during remediation. However, all potential risks during implementation could be controlled through administrative and engineering controls. Additional waste generated during remediation will consist only of small quantities of equipment decontamination fluids and discarded personal protective clothing and equipment. Therefore, Alternative 3 meets specified remedial action objectives and provides for overall protection of human health and the environment.

9.8.2 Compliance with ARARs and TBCs

The ARARs and TBCs for Alternative 3a, removal, ex situ thermal treatment, and disposal, are presented in Table 25. The substantive requirements of RCRA and Idaho Administrative Procedures Act (IDAPA) ARARs specific to hazardous waste will be met. Use of air-monitoring and dust-suppression techniques during construction and excavation will ensure compliance with emissions ARARs. Control of off-gases generated during the thermal treatment process will be the responsibility of the treatment vendor and is not relevant to actions conducted within WAG 5. The site will be surveyed for cultural and archeological resources and appropriate actions will be taken to satisfy ARARs for protection of sensitive resources. The DOE Order 5400.5 TBC would be met through administrative and engineering controls to limit exposures to allowable levels. The selected alternative is, therefore, capable of complying with ARARs and TBCs.

9.8.3 Cost-Effectiveness

The selected remedy is cost-effective because it is the least costly alternative that satisfies threshold criteria. When compared to other potential remedial actions, the selected remedy provides the best balance between cost and effectiveness in protecting human health and the environment.

Table 24. Cost estimate summary for the ARA-02 sanitary waste system selected remedy.

Planned Activity		Cost (Fiscal Year 1998 dollars)
FFA/CO management and oversight		
	WAG 5 management	375,000
Remedial design		
	Remedial design/remedial action Scope of Work	54,000
	Remedial action work plan	63,000
	Packaging, shipping, transportation documentation	48,000
	Remedial action report	48,000
	Data collection and management for first 5-year review	141,000
	Safety analysis documentation	101,000
	Sampling and analysis plan	108,000
	Pre-final inspection report	8,000
	Legal review	32,000
	Total title design package	98,000
	Site characterization	20,000
Remedial action—construction subcontract		
	Construction subcontract	351,000
Project construction management		80,000
Support for construction subcontract		142,000
CAPITAL COST SUBTOTAL		1,669,000
	Contingency @ 30%	501,000
TOTAL CAPITAL COST IN FISCAL YEAR 1998 DOLLARS		2,169,000
TOTAL CAPITAL COST IN NET PRESENT VALUE		2,019,000
Operations		
	Program management	NA
	Data collection and management for 5-year reviews	NA
	Maintenance	NA
	Decontamination and dismantlement	NA
	Surveillance	NA
OPERATIONS AND MAINTENANCE COST SUBTOTAL		NA
	Contingency @ 30%	NA
TOTAL OPERATIONS AND MAINTENANCE COST IN FISCAL YEAR 1998 DOLLARS		NA
TOTAL OPERATIONS AND MAINTENANCE COST IN NET PRESENT VALUE		NA
TOTAL PROJECT COST IN NET PRESENT VALUE		2,019,000

Table 25. ARARs and TBCs for the selected alternative—removal, ex situ thermal treatment and disposal—for the ARA-02 Sanitary Waste System.

Category	Citation	Reason	Relevancy
Action-specific applicable, relevant, and appropriate requirements (ARARs)			
Rules for the Control of Air Pollution in Idaho	Toxic Substances IDAPA 16.01.01.161 Toxic Air Emissions IDAPA 16.01.01.585 and .586	The release of carcinogenic and noncarcinogenic contaminants into the air must be estimated before the start of construction, controlled, if necessary, and monitored during excavation of soil, removal of seepage pit sludge, cinder blocks, septic tanks and piping, and decontamination of septic tanks and piping.	A[a]
	Fugitive Dust IDAPA 16.01.01.650 and .651	Requires control of dust at all times, especially during excavation and removal of the seepage pit sludge, cinder blocks, septic tanks, and piping.	
	Requirements for Portable Equipment IDAPA 16.01.01.500.02	Portable equipment for removal of the seepage pit and septic tank system, and any portable support equipment must be operated to meet state and federal air emissions rules.	A
National Emission Standards for Hazardous Air Pollutants (NESHAP)	Radionuclide Emissions from DOE Facilities 40 CFR 61.92 Emission Monitoring 40 CFR 61.93 Emission Compliance 40 CFR 61.94(a)	Limits exposure of radioactive contamination release to 10 mrem/year for the off-Site receptor, and establishes monitoring and compliance requirements.	A
Resource Conservation and Recovery Act—Standards Applicable to Generators of Hazardous Waste	Hazardous Waste Determination IDAPA 16.01.05.006 (40 CFR 262.11)	A hazardous waste determination is required for the septic tanks, piping, and any secondary waste disposed of on the INEEL.	A

Table 25. (continued).

Category	Citation	Reason	Relevancy
Resource Conservation and Recovery Act—Standards for Owners and Operators of Hazardous Waste Treatment Storage and Disposal Units	General Waste Analysis IDAPA 16.01.05.008 (40 CFR 264.13 (a)(1-3))	Analysis requirements apply to the seepage pit sludge, cinder blocks, septic tanks, piping, and secondary waste generated during remediation.	A
	General Inspections IDAPA 16.01.05.008 (40 CFR 264.15)	Regular inspections must be performed during remediation.	A
	Preparedness and Prevention IDAPA 16.01.05.008 (40 CFR 264 Subpart C)	Applies to soil excavation, waste and debris removal, and decontamination activities.	A
	Contingency Plan and Emergency Procedures IDAPA 16.01.05.008 (40 CFR 264 Subpart D)	Applies to soil excavation, waste and debris removal, and decontamination activities.	A
	Equipment Decontamination IDAPA 16.01.05.008 (40 CFR 264.114)	All equipment used during remediation must be decontaminated if hazardous waste is contacted.	A
	Use and Management of Containers IDAPA 16.01.05.008 (40 CFR 264.171–177)	Applicable to the seepage pit sludge, cinder blocks, septic tanks, piping, and any secondary hazardous waste generated during remediation and managed in containers.	A
	Tank Closure and Post Closure Care IDAPA 16.01.05.008 (40 CFR 264.197(a))	Applies to seepage pit sludge, cinder blocks, septic tanks, and piping.	A
Resource Conservation and Recovery Act—Land Disposal Restrictions	Treatment Standards IDAPA 16.01.05.011 (40 CFR 268.40 (a)(b)(e))	Seepage pit sludge, cinder blocks, septic tanks, and piping must be treated if necessary to meet land disposal restriction criteria before disposal commences.	A
	Treatment Standards for Hazardous Debris IDAPA 16.01.05.011 (40 CFR 268.45 (a–d))		A

Table 25. (continued).

Category	Citation	Reason	Relevancy
	Universal Treatment Standards IDAPA 16.01.05.011 (40 CFR 268.48 (a))		A
National Oil and Hazardous Substances Pollution Contingency Plan – Hazardous Substance Response	Procedures for Planning and Implementing Off Site Response Actions 40 CFR 300.440	Applies to all waste disposed of off the INEEL.	A
Location-specific ARARs			
National Historic Preservation Act	Historic properties owned or controlled by Federal agencies 16 USC 470 h-2 Identifying Historic Properties 36 CFR 800.4 Assessing Effects 36 CFR 800.5	The site must be surveyed for cultural and archeological resources before the commencement of construction, and appropriate actions must be taken to protect any sensitive resources.	A
Native American Graves Protection and Repatriation Act	Custody 25 USC 3002 (43 CFR 10.6) Repatriation 25 USC 3005 (43 CFR 10.10)	The site must be surveyed for cultural and archeological resources before the commencement of construction, and appropriate actions must be taken to protect any sensitive resources.	A
To be considered (TBC) guidance			
Radiation Protection of the Public and the Environment	DOE Order 5400.5, Chapter II (1)(a, b)	Limits the effective dose to the public from exposure to radiation sources and airborne releases.	

a. A = Applicable.

9.8.4 Use of Permanent Solutions and Alternative Treatment Technologies

The selected remedy, Alternative 3, removal, ex situ thermal treatment, and disposal, provides a permanent solution because the seepage pit sludge will be permanently removed; thermally treated to reduce contaminant toxicity, mobility and volume; and disposed of in a facility off WAG 5 designed for long-term isolation and protection. In addition, all contaminated components of the septic system will be permanently removed from the site and disposed of in an equally protective facility off WAG 5. Because the septic tanks, pipes, and pumice blocks of the seepage pit are porous, decontamination of the surfaces to meet a clean debris standard is not considered practical. Though the structural components of the ARA-02 Sanitary Waste System are expected to meet the criteria for disposal at Envirocare or an INEEL facility without treatment, the waste can be easily and cost-effectively encapsulated if required. Because all contamination will be removed from WAG 5, no monitoring or maintenance will be required for the site after remediation is completed.

9.8.5 Preference for Treatment as a Principal Element

Alternative 3, removal, ex situ thermal treatment, and disposal, includes incineration of the seepage pit sludge, which is the most effective treatment available at the INEEL for destroying organics and reducing volume. If required, the waste can be stabilized at WERF to meet the waste acceptance criteria for Envirocare. Stabilization of the waste will reduce the mobility of the remaining inorganic contaminants. Therefore, the selected alternative satisfies the preference for treatment as a principal element of the selected remedy.

9.8.6 Five-Year Reviews

Five-year reviews will be conducted for all sites with institutional controls. Land use will be restricted at ARA-02 until remediation is implemented as prescribed in this ROD. Land-use controls will not be required after remediation if all contaminated sludge is removed to basalt or if contaminant concentrations are comparable to local background values for soil. Otherwise, institutional controls will be maintained until discontinued based on the results of a 5-year review.